**B777 Alerting Issues – Uncommanded yaw or roll**

**1. Initiating Condition: Wake encounter**

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| **Visual Alerts** | PFD bank angle indicator turns amber | Bank angle > 35 degrees | | | | Reduction of bank angle |
| **Aural Alerts** | GPWS "Bank Angle" | 35, 40, and 45-degree bank angle | Alert not definitive as to cause | | | |
| **Tactile Alerts** | None | | | | | |
| **Visual Cues** | Roll rate on PFD/EADI | | Underlying cause of the yaw/roll may not be cued, or the cues may be ambiguous/require effortful interpretation | | | |
| **Aural Cues** | None | | | | | |
| **Tactile/ Somatic Cues** | In normal flight control mode, when bank angle exceeds 35 degrees, the aircraft automatically applies control wheel forces to attempt to restore a 30 degree bank angle. This will present to the pilot as wheel force (can be overridden) and anti-roll wheel deflection. | | Underlying cause of the wheel deflection may not be cued, or the cues may be ambiguous/require effortful interpretation. It may not be clear to the pilots whether the wheel inputs are causing the upset or responding to it. | | | |

**Expected Pilot Response(s)**

- Disconnect autopilot/autothrottle
- Turn off flight directors
- Apply opposing roll and/or yaw inputs to control aircraft attitude
- Recover from nose-down upset if necessary

**Possible sources of confusion with regard to pilot response(s)**

- Pilots may have to react to an uncommanded roll with different controls (wheel vs. rudder pedals) depending on the cause, which will probably be unclear based on the lack of definitive cues and the extreme time pressure. (Note: The procedures instruct pilots to use "all available controls" which is an attempt to reduce the diagnostic workload.)

**B777 Alerting Issues – Uncommanded yaw or roll**

1. Initiating Condition: Wake encounter – Cont.

**How does pilot know condition is resolved/recovered?**

- Condition is resolved when aircraft control is regained.

**Issues with regard to multiple concurrent non-normal conditions**

- Pilots may be confronted with unusual flight control difficulties and/or alerts/cues as they cope with a roll or yaw/roll upset

**B777 Alerting Issues – Uncommanded yaw or roll**

**2. Initiating Condition: Uncommanded rudder deflection**

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| **Visual Alerts** | PFD bank angle indicator turns amber | Bank angle > 35 degrees | | | | Reduction of bank angle |
| **Aural Alerts** | GPWS "Bank Angle" | 35, 40, and 45-degree bank angle | Alert not definitive as to cause | | | |
| **Tactile Alerts** | None | | | | | |
| **Visual Cues** | Roll rate on PFD/EADI | | Underlying cause of the yaw/roll may not be cued, or the cues may be ambiguous/require effortful interpretation | | | |
| | Aileron, spoiler, and rudder positions displayed on the MFD FCTL synoptic page | | | This information must be obtained by performing keyboard selections; thus has zero salience unless the pilot recalls the existence of the page, applies this to the existing situation, and effort fully makes the required entries | | |

**B777 Alerting Issues – Uncommanded yaw or roll**

**2. Initiating Condition: Uncommanded rudder deflection**

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| **Aural Cues** | None | | | | | |
| **Tactile/ Somatic Cues** | Lateral-g | | | | | |
| | Uncommanded rudder deflection may result in pro-yaw rudder pedal deflection or force and/or rudder pedal jam, depending on source of uncommanded control surface deflection; however, in other failure conditions there will be no rudder pedal movement cueing the deflection of the rudder. Also, with autopilot engaged, depending on the lateral mode, it may apply anti-yaw wheel inputs. Other roll control inputs made by the flight control system will not result in wheel movement | | Underlying cause of the rudder and/or wheel deflections may not be cued, or the cues may be ambiguous/require effortful interpretation. It may not be clear to the pilots whether the control inputs are causing the upset or responding to it. | Interpretation of rudder and wheel deflections can be difficult because the direction of deflection (into or opposite the yaw) depends on the underlying cause | | |

**B777 Alerting Issues – Uncommanded yaw or roll**

2. Initiating Condition: Uncommanded rudder deflection – Cont.

**Expected Pilot Response(s)**

- Disconnect autopilot/autothrottle.
- Turn off flight directors.
- Apply opposing roll and/or yaw inputs to control aircraft attitude, using significant force if necessary to activate breakout features in the event of control jam.
- Recover from nose-down upset if necessary.

**Possible sources of confusion with regard to pilot response(s)**

- Pilots may have to react to an uncommanded roll with different controls (wheel vs. rudder pedals) depending on the cause, which will probably be unclear based on the lack of definitive cues and the extreme time pressure. (Note: The procedures instruct pilots to use "all available controls" which is an attempt to reduce the diagnostic workload.)

**How does pilot know condition is resolved/recovered?**

- Condition is resolved when aircraft control is regained and uncommanded control deflections have been either neutralized or compensated for in all anticipated circumstances for the remainder of the flight.
- If there are residual uncommanded control deflections or pressures, there may be operational implications through to landing (e.g., crosswind limitations)

**Issues with regard to multiple concurrent non-normal conditions**

- Pilots may be confronted with unusual flight control difficulties and/or alerts/cues as they cope with a roll or yaw/roll upset

**B777 Alerting Issues – Uncommanded yaw or roll**

**3. Initiating Condition: Uncommanded aileron/spoiler/flap/slat deflection**

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| **Visual Alerts** | PFD bank angle indicator turns amber | Bank angle > 35 degrees | | | | Reduction of bank angle |
| **Aural Alerts** | GPWS "Bank Angle" | 35, 40, and 45-degree bank angle | Alert not definitive as to cause | | | |
| **Tactile Alerts** | None | | | | | |
| **Visual Cues** | Roll rate on PFD/EADI | | Underlying cause of the yaw/roll may not be cued, or the cues may be ambiguous/require effortful interpretation | | | |
| | Aileron, spoiler, and rudder positions displayed on the MFD FCTL synoptic page | | | This information must be obtained by performing keyboard selections; thus has zero salience unless the pilot recalls the existence of the page, applies this to the existing situation, and effortfully makes the required entries | | |
| **Aural Cues** | None | | | | | |
| **Tactile/ Somatic Cues** | Uncommanded aileron, spoiler, or flap deflection may result in pro-roll wheel deflection or force and/or control wheel jam, depending on source of uncommanded control surface deflection; however, in other failure | | | Interpretation of wheel deflection is difficult because the direction of deflection (into or opposite the roll) depends on the underlying cause | | |

**B777 Alerting Issues – Uncommanded yaw or roll**

**3. Initiating Condition: Uncommanded aileron/spoiler/flap/slat deflection**

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| | conditions there will be no wheel movement cueing the deflection of the ailerons and/or spoilers. Also, with autopilot engaged, depending on the lateral mode, it may apply anti-roll wheel inputs. Other roll control inputs made by the flight control system will not result in wheel movement. | | | | | |

**B777 Alerting Issues – Uncommanded yaw or roll**

3. Initiating Condition: Uncommanded aileron/spoiler/flap/slat deflection – Cont.

| Type | Alert or cue | Threshold for alert or cue to be presented | Confusion regarding alert or cue | Other issues with regard to alert or cue | When alert is inhibited/ suppressed or when cue is masked | How alert or cue is terminated |
|---|---|---|---|---|---|---|
| **Tactile/ Somatic Cues** | In normal flight control mode, when bank angle exceeds 35 degrees, the aircraft automatically applies control wheel forces to attempt to restore a 30 degree bank angle. This will present to the pilot as wheel force (can be overridden) and anti-roll wheel deflection. | | Underlying cause of the wheel deflection may not be cued, or the cues may be ambiguous/require effortful interpretation. It may not be clear to the pilots whether the wheel inputs are causing the upset or responding to it. | Interpretation of wheel deflection is difficult because the direction of deflection (into or opposite the roll) depends on the underlying cause | | |

**B777 Alerting Issues – Uncommanded yaw or roll**

3. Initiating Condition: Uncommanded aileron/spoiler/flap/slat deflection – Cont.

**Expected Pilot Response(s)**

- Disconnect autopilot/autothrottle.
- Turn off flight directors.
- Apply opposing roll and/or yaw inputs to control aircraft attitude, using significant force if necessary to activate breakout features in the event of control jam.
- Recover from nose-down upset if necessary.

**Possible sources of confusion with regard to pilot response(s)**

- Pilots may have to react to an uncommanded roll with different controls (wheel vs. rudder pedals) depending on the cause, which will probably be unclear based on the lack of definitive cues and the extreme time pressure. (Note: The procedures instruct pilots to use "all available controls" which is an attempt to reduce the diagnostic workload.)

**How does pilot know condition is resolved/recovered?**

- Condition is resolved when aircraft control is regained and uncommanded control deflections have been either neutralized or compensated for in all anticipated circumstances for the remainder of the flight.
- If there are residual uncommanded control deflections or pressures, there may be operational implications through to landing (e.g., crosswind limitations).

**Issues with regard to multiple concurrent non-normal conditions**

- Pilots may be confronted with unusual flight control difficulties and/or alerts/cues as they cope with a roll or yaw/roll upset.